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# The American Fertilizer

Vol. 101 AUGUST 26, 1944 No. 1

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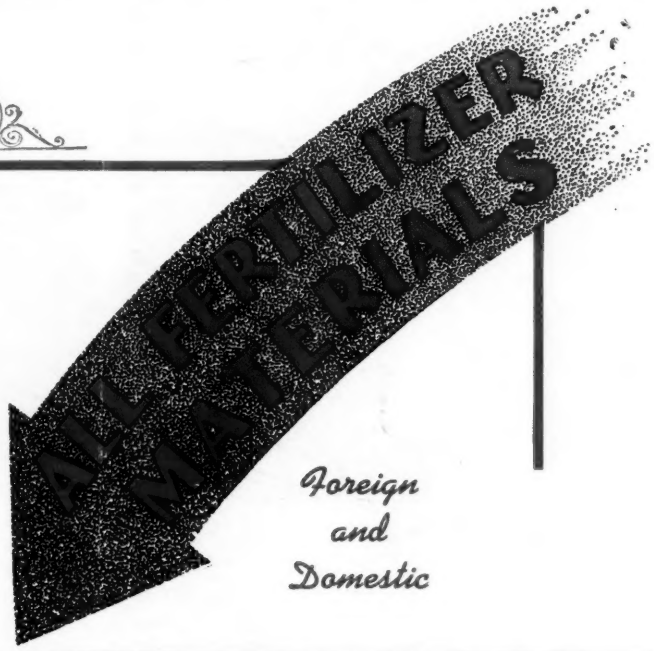


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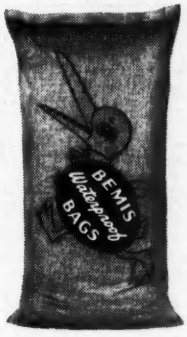


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# AMERICAN FERTILIZER

"That man is a benefactor to his race who makes two blades of grass to grow where but one grew before."

Vol. 101 AUGUST 26, 1944 No. 4

# Soil Fertility in Its Broader Implications*

By WM. A. ALBRECHT

*Soils Department, College of Agriculture, University of Missouri*

A BUSINESS can expect to grow only as it gets and digests new ideas, adopts new discoveries and utilizes new scientific facts. The fertilizer business is no exception. It is founded on the science of the soil, the science of chemistry, and other sciences. The fertilizer business, for best growth, must follow closely all new ideas, new concepts and new facts in soil science first, because the soil is its market; the soil is its field of service.

We feel that it might be to the advantage of you men in the fertilizer business to spend some time today in thinking about, and trying to understand, some fundamental principles recently developed in soil science with significant implications for agriculture and for those not so closely connected with agriculture. We are all decidedly dependent on the soil for our food. Such thinking about the soil is invited because of the belief that by it the fertilizer industry may be a better help to agriculture and, by what we may call an enlightened self interest, may be a better help to itself. In giving better service the industry will be justified in serving itself the better.

Because fertilizers are a means of adding to the fertility or the potential producing power of the soil, your attention is invited to the broad subject of "Soil Fertility in Its Broader Implications."

If an unfortunate situation in the fertilizer business dare be pointed out—not as a criticism—we might say that it is a case of plenty of pharmacists but too few doctors. The medicine for the soil as the patient is for sale, but the bonafide prescriptions are too few. Knowledge of the symptoms and physiology of the patient are needed as well as of materia medica. Since the soil is really the patient that is being treated, it is essential that we have some knowledge about the soil.

Too long have we been laboring under the belief that we fertilize only the crop. The fertilizer is only supplementary nourishment to what the soil gives to the plant. That supplement must balance properly the offerings by the soil, and at the proper time and in proper position within the soil. It is essential therefore that we think first of the soil in planning the most efficient services by fertilizers as helps to the soil. It is significant that we become not only erosion-conscious but also soil fertility-conscious when it was the depletion of the soil fertility, and a failure of Nature to grow cover, that brought on erosion.

Food is fabricated soil fertility. It is food that must win the war and write the peace. Consequently, the questions as to who will win the war and how indelibly the peace will be written will be answered by the reserves of soil fertility and the efficiency with which they can be mobilized for both the present and the post-conflict eras.

National consciousness has recently taken consideration of the great losses by erosion from the body of the surface soil. We have also come to give more than passive attention to malnutrition on a national scale. Not yet, however, have we recognized soil fertility as the food-producing forces within the soil that reveal national and international patterns of weakness or strength. Soil fertility, in the last analysis, must not only be mobilized to win the war, but must also be preserved as the

*An address before the National Fertilizer Association, Atlanta, June 21, 1944.

standing army opposing starvation for the maintenance of peace.

What is soil fertility? In simplest words, it is some dozen chemical elements in mineral and rock combinations in the earth's crust that are being slowly broken out of these and hustled off to the sea. Enjoying a temporary rest stop enroute, they are a part of the soil and serve their essential roles in nourishing all the different life forms. They are the soil's contribution—from a large mass of non-essentials—to the germinating seeds that empowers the growing plants to use sunshine energy in the synthesis of atmospheric elements and rainfall into the many crops for our support. The atmospheric and rainfall elements are carbon, hydrogen, oxygen, and nitrogen, so common everywhere.

It is soil fertility that constitutes the five per cent that is plant ash. It is the handful of dust that makes up the corresponding percentage in the human body. Yet it is the controlling force that determines whether Nature in her fabricating activities shall construct merely the woody frameword with leaf surfaces catching sunshine and with root surfaces absorbing little more than water, or whether inside of that woody shell there shall be synthesized the innumerable life-sustaining compounds.

Soil fertility determines whether plants are foods of only fuel and fattening values, or of body service in growth and reproduction. Because the soil comes in for only a small percentage of our bodies, we are not generally aware of the fact that this five per cent can predetermine the fabrication of the other ninety-five per cent into something more than mere fuel.

### History Records Changing Politics Rather Than Declining Soil Fertility

Realization is now dawning that a global war is premised on a global struggle for soil fertility as food. Historic events in connection with the war have been too readily interpreted in terms of armies and politics and not premised on mobilized soil fertility. Gafsa, merely a city in North Africa, was rejuvenation for phosphorus-starved German soils. Nauru, a little island speck in the Pacific, is a similar nutritional savior to the Japanese. Hitler's move eastward was a hope looking to the Russian fertility reserves. The hoverings of his battleship, Graf Spee, around Montevideo, and his persistence in Argentina were designs on that last of the world's rich store of less exploited soil fertility to be had in the form of corn, wheat, and beef much more than they were maneuverings for political or naval advantage. Some of these historic martial events serve to remind us that "an empty stomach knows no laws" and that man is in no unreal sense an animal that becomes a social and political being only after he has consumed some of the products of the soil.

### Differences in Soil Fertility Give Us an East and a West as Well as a North and a South

In view of our youthfulness as an extensive country, our different geographic areas have registered themselves mainly as differences in body comfort, whether hot or cold, wet or dry. The free flow of foods and food constituents by means of cheap transportation has not allowed recognition of differences in quality as well as in kind of our foods in adjoining districts according to soil differences. We have not yet marked out our country into the smaller patchwork districts with distinctive local colorings as the Old World has in the opinion of visitors from the New World. Limitations in travel, difficulties in food delivery, and all the other restrictions now making us more local, will soon emphasize differences and deficiencies according to the soils by which we live.

Geographic divisions to give us an East and a West, and a North and a South for the eastern half of the country, are commonly interpreted as separations according to differences in modes of livelihood, social customs, or political affiliations. Differences in rainfall and temperature are readily acknowledged. But that these weather the basic rock to make soils so different that they control differences in vegetation, animals, and humans, by control of their nutrition is not so readily granted. That "we are as we eat" and that we eat according to the soil fertility, are truths that will not so generally and readily be accepted. Acceptances are seemingly to come not by deduction but rather through disaster.

### Patterns of Nourishment Are Premised on the Pattern of Soil Fertility

We have been speaking about vegetation by names of crop species and by tonnage yields per acre. We have not considered plants for their chemical composition and nutritive value according to the fertility in the soil producing them. This failure has left us in confusion about crops and has put plant varieties into competition with—rather than in support of—one another. Now that the subject of nutrition is on most every tongue, we are about ready for the report that vegetation as a deliverer of essential food products of its own synthesis is limited by the soil fertility.

Proteinaceousness and high mineral contents, as distinct nutritive values, are more common in crops from soils formed in regions of lower rainfall and of less leaching as for example the "Midlands," or the midwestern part of the United States. "Hard" wheat, so-called because of its high protein content needed for milling the "patent" flour for "light" bread, is commonly ascribed to regions of lower annual rainfalls. "Soft wheat" is similarly ascribed to regions of higher rainfalls. The high calcium content, the other liberal mineral reserves, and the pronounced activities of nitrogen within the less-leached soil, however, are the causes when experimental trials supplying the soil with these fertility items in high rainfall regions can make hard wheat where soft wheat is common.

**Proteinaceous Crops and Healthy Animals Go With Fertile Soils. Carbonaceous Crops and Troubles With Animals Go With Depleted Soils**

The proteinaceous vegetation and the synthesis by it of many unknowns which, like proteins, help to remove hidden hungers and encourage fecundity of both man and animal are common in the prairie regions marked by the moderate rainfalls. It is the soil fertility, rather than the low precipitation, that gives the Midwest, or those areas bordering along approximately the 97th meridian these distinctions: (a) its selection by the bison in thundering herds on the "buffalo grass"; (b) the wheat which taken as a whole rather than as refined flour is truly the "staff of life"; (c) animals on range nourishing themselves so well that they reproduce regularly; and (d) the more able-bodied selectees for military service of whom seven out of ten are chosen in contrast to seven rejected out of ten, in one of the southern states where the soils are more exhausted of their fertility.

Protein production, whether by plant, animal, or man, makes demands on the soil-given elements. Body growth among forms of higher life is a matter of soil fertility and not only one of photosynthesis. It calls for more than rainfall, fresh air and sunshine.

The heavier rainfall and forest vegetation of the eastern United States mark off the soils that have been leached of much fertility. Higher temperatures in the southern areas have made more severe the fertility-reducing effects of the rainfall. Consequently, vegetation there is not such an effective synthesizer of proteins. Neither is it a significant provider of calcium, phosphorus, magnesium, or the other soil-given, foetus-building nutrients. Annual production as tonnage per acre is large, particularly in contrast to the sparsity of that on the western prairies. The East's production is highly carbonaceous, however, as the forests, the cotton, and the sugar cane testify. The carbonaceous nature is contributed by air, water, and sunlight more than by the soil. Fuel and fattening values are more prominent than are aids to growth and reproduction.

Here is a basic principle that cannot be disregarded. It has signal value as we face nutritional problems on a national scale. It is, of course, true that soils under higher rainfalls and temperatures still supply some fertility for plant production. Potassium, however, dominates that limited supply to give prominence to photosynthesis of carbonaceous products. The insufficient provision of calcium and of all the other requisite elements usually associated with calcium does not permit the synthesis, by internal performances of plants, of the proteins and many other compounds of equal nutritive value. The national problem is largely one of mobilizing the calcium and other fertility elements for growing protein and not wholly one of redistributing proteins under federal controls. The soil fertility pattern on the map delineates the various areas of particular success or particular trouble in nutrition. It marks out the areas where, by particular soil treatments, the starving plants can be given relief.

**The Fertility Pattern of Europe Is a Mirror Picture of Our Own**

The more concentrated populations in the United States are in the East and on the soils of lower fertility. For those people, Horace Greeley spoke with good advice when he said, "Go West, young man." It was well that they trekked to the semi-humid midwest where the hard wheat grows on the chernozem soils, and where both the bread basket and the meat basket are well-laden and carried by the same provider, viz; the soil. It was that move that spelled our recent era of prosperity.

In Europe the situation is similar but the direction of travel was reversed and the time period has been longer. It is western Europe that represents the concentrated populations on soils of lower fertility under heavier rainfall. Peoples there reached over into the pioneer United States for soil fertility by trading for it the goods "made in Germany." More recently the hard wheat belt on the Russian chernozem soils has been the fertility goal under the Hitlerian move-eastward. Soil

(Continued on page 24)

# Post-War Problems in Agriculture*

By W. S. BROWN
*Director, Agricultural Extension Service, Athens, Ga.*

PERHAPS a better title for this paper would be "Post-War Trends in Agriculture," but regardless of how we start out, we usually end up with post-war planning. So I guess the title doesn't make so much difference after all. We realize that at best we are all more or less groping in the dark. No one knows definitely at this time just what our post-war problems will be or how they may be met. A great deal depends upon how much longer the war lasts; whether it ends with the "dramatic suddenness" of the last war, or terminates gradually. The agreements reached at the final peace conference will also very materially affect and determine our agricultural problems after the war.

We do know that a great deal of thought and effort is being devoted to post-war problems and post-war planning by many different groups, agencies and organizations. In fact, almost every group has its post-war plan. The same is true with many, many individuals.

It is also very evident that there is considerable difference of opinion among these groups and individuals both as to prospective problems and their solution. This, I think, may be taken as a fair indication of the conflicting opinions and interests which we may expect both on the national and international level, when post-war problems become a reality and we meet them face to face.

As I said, we do not know definitely just what form our post-war problems will take. Certainly we cannot outline definite solutions for problems which we cannot clearly foresee. However, there are certain general needs and adjustments which I think we can anticipate. There are also certain fundamental principles, practices, and trends upon which we can safely rely in mapping any program which may seem advisable. One of these principles is that agricultural planning is a continuous process.

The splendid food production record which farm people have made and are making as their part of the war effort is not altogether the result of our Food for Victory campaign. The fact that we are at war, and our soldiers and civilians need this food, provided a tremendous incentive for our farmers to plan and work for increased production but it was the careful planning and adjusting of the cropping system, the soil improvement work, the use of improved varieties and breeds of crops and livestock, the more efficient use of fertilizers and machinery, and other sound farm practices over the years that enabled them to achieve record-breaking results.

With one exception, so far, in our wartime production program it has not been necessary for farmers to make any radical changes in their programs. On the other hand, it has resulted in emphasizing and speeding up and intensifying certain trends, practices and systems of farming that were already well under way. In other words, the was has simply hastened our progress toward a sound, well rounded, well balanced farm program. Likewise, in the post-war period, we must still rely upon the continuation of sound farm practices, experiences, and trends in making the necessary adjustments with which we will be faced.

The one exception, particularly in Georgia, is in peanut production. The 1942 peanut crop in Georgia increased 85 per cent over 1941; the 1943 crop was a 12 per cent increase over 1942, and the indications are that the 1944 acreage will at least equal that of 1943. This tremendous increase, in order to meet quotas, has necessitated planting peanuts after peanuts which is not a sound practice from the standpoint of maintaining soil fertility.

Broadly speaking, one of our chief post-war problems will be to prevent the breaking down or a reversal of some of these desirable trends which have been in evidence not only during the war but for a good many years prior to the present war. Some of the more important of these trends are: (1) fewer people on farms, (2) larger production per farm worker, (3) better balance between crop and livestock enterprises, (4) more complete and more efficient utilization of farm land and farm labor.

*An address before the National Fertilizer Association, Atlanta, June 21, 1944.

One fundamental problem which Georgia and the other Southeastern States have always had is the combined disadvantage of a heavy per acre farm population and relatively low producing soil. During the ten-year period immediately preceding the outbreak of World War II, the average acreage of crop land per capita of farm population in Georgia was 7.7 acres or about half the national average of 15 acres per farm person. Then the average production capacity of our soils, measured by actual crop yields, was about 45 per cent of the average for the United States as a whole. These two factors working together resulted in relatively low production per farm worker and consequently low income per capita of our farm population. In other words, for a long number of years it has been necessary to divide too little among too many.

In the face of this situation, the Experiment Stations, Extension Service, College of Agriculture, Soil Improvement Committees, and other organizations, have for a long number of years been working on a soil building and soil conserving program. During the last decade this program has been greatly implemented and accelerated by the AAA and the SCS. I think we can say that considerable progress is being made along the line of soil improvement.

### Decline in Farm Population

Within the last few years, more than 250,000 people have gone from Georgia farms. The number of farms in Georgia has dropped from 255,000 in 1935 to 216,000 in 1940, and the average size of our farms has increased from 101 acres to 109.6 acres during the same period. In 1930 the average farm was 86 acres.

It is true that this wholesale exodus from farms has resulted in serious labor shortage, but with the exception of the boys who have gone to the armed forces, it is fundamentally a very sound and wholesome trend. Those who went from the farm to industrial work did so because the change afforded them a higher income. And, in spite of the fact that Georgia farm population has decreased nearly 20 per cent since January 1, 1940, the acreage of cropland has not decreased and the total agricultural production has actually increased. Since total agricultural production and total farm income has increased and since there are fewer people on farms to participate in this increase, it follows, necessarily, that the average per capita farm production and income has materially increased. The figures used in this paper are largely Georgia figures but they are fairly typical of the other Southern States.

In this connection, there are two important problems that have a direct bearing upon the matter of increased per capita farm income. They are also factors which should receive serious consideration in all well-rounded post-war planning. These problems are: (1) full employment for all who want to work, and (2) a proper balance between agriculture and industry in order that both may make their greatest contribution to a balanced national economy.

Full employment after the war depends to a great extent upon maintaining our national income at a high level. This involves national and international factors which we do not have time to discuss. But if full industrial employment can be maintained there will be no necessity for the enormous "back to the farm" movement which has accompanied periods of low national income in the past and has resulted in loverloading agriculture with people at a time when the farms were least able to support them. The boys who left the farm to join the armed forces should be accorded every encouragement and opportunity possible if they want to return to the farm, but as stated by Secretary Wickard, "Before the war period, more farm families were trying to get a living from the land than could be provided efficient family-size farms. There just wasn't enough good land for all the farm people. Hundreds of thousands of these surplus farm families have now been drawn off into city work. Instead of pushing back into agriculture those people who are not needed there, farmers believe they should be afforded continued opportunities to do useful work in non-agricultural occupations."

Then, since practically 85 per cent of our national income goes to non-agricultural people who buy most of the products which the farmer has for sale, the attainment of a proper balance between agriculture and industry will depend very largely upon the extent to which full industrial employment is available.

### Better Balance in Farm Output

Considerable progress has already been made by farmers in regard to a better balance between crop and livestock enterprises. For example, in Georgia, we are planting little more than 25 per cent of the land in cotton that we were planting 25 years ago but we are producing practically half as much cotton. In other words, we are producing about 21 per cent more cotton per acre than we were in pre-boll weevil days. The great majority of

this land taken out of cotton has gone into grain, hay, pasture, and specific soil building crops. Some of it has gone back to forestry.

As a result of this trend, the 1943 cash income from livestock and livestock products was $98,174,000 while the income from cotton and cottonseed was $92,014,000.

This balance between crops and livestock requires less hand labor on the farm and provides a more even distribution of the labor employed. It also automatically fits into and to a great extent provides a soil conserving and soil building program since the best pasture grasses and feed crops are in most cases the best soil conservation crops. Post-war plans should aim definitely at continuing the development of this balanced system of farming.

Care and protection of our forest lands should receive increased attention after the war along with our crop land. Both are being drawn upon very heavily in the war emergency period. We must come more to regard the farm woodland as an integral part of the farm. More attention must be given to protection against uncontrolled burning and our timber should be harvested and marketed with the same systematic care with which we would handle any other crop.

One outstanding problem in the complete utilization of land and labor is that of adequately mechanizing our farms. If the average Georgia farm was properly equipped with machinery, the labor problem would not be nearly as serious as it is today. The scarcity of machinery and the rationing of machinery came just when the mechanizing of Georgia farms was really getting under way. But in 1940 only 3.8 per cent of Georgia farms were equipped with tractors.

Iowa stood first with 65 per cent of her farms equipped with tractors and tractor-drawn machinery. The average of all the States was 23 per cent. So when farm machinery was allotted on a historical base you can readily see why we are not getting larger quotas.

### Post-War Cotton

Notwithstanding the gains in income from livestock and crops other than cotton, the future of the Georgia farmer, and that of most other Southern farmers, is concerned to a very great extent with what happens to cotton after the war. Not only does the cotton crop concern the southern farmer and the South but it concerns the economy of the entire nation. In the past, cotton has contributed heavily to our balance in world trade.

Some people predict that cotton will not be able after the war to compete with synthetic fiber and with cotton produced in foreign countries. It is true that in 1930 the production of synthetic fiber was sufficient to replace about one million bales of cotton, while in 1943 it was sufficient to replace about eight million bales. It is also true that the price of staple rayon has dropped from 60 cents per pound in 1930 to 24 cents per pound in 1943. It is freely predicted that after the war staple rayon will sell for as low as 15 cents per pound. On the other hand, there are many uses for cotton that have not been successfully met with synthetic fiber and the vast amount of research now under way will undoubtedly develop many new uses for cotton. The fact remains, however, that synthetic fiber presents a definite challenge to cotton growers and processors.

In regard to competition from foreign countries, we know that there is a great deal of actual and potential cotton land outside of the United States. We know that there is a considerable amount of cotton being carried over outside of the United States. We have every reason to believe that Europe will buy cotton where it can be bought cheapest. We know the low wage scale and standard of living of most of the foreign cotton producing countries.

### Mechanical Farm Equipment Needed

In view of the foregoing situation, the cotton farmer, as we see it, will be compelled to make some very definite changes and adjustments in his methods of production and marketing if he is to successfully meet this competition. In other words, he will be obliged to increase the production per man and greatly lower the cost of production. In my opinion, this involves power farm equipment.

Today two-row tractor equipment is being used successfully even in the hilly Piedmont section. One man with tractor equipment can now prepare, plant and cultivate around 100 acres of cotton up to the point of harvest. After the war we believe the mechanical cotton picker will be used extensively. With this equipment this same one man could not only produce 100 or more acres of cotton but he would be able to harvest it.

It is true that the present mechanical cotton pickers lower the grade from one to two grades below hand picked cotton but both pickers and cleaning machinery are being improved steadily. By the end of the war, it

(Continued on page 30)

# IT MAY BE

By SAMUEL L. VEITCH

## WAR PRODUCTION PEAK HAS BEEN REACHED

Courses at several colleges have already begun, teaching volunteer scholars the routine of terminating Government Contracts (cost, $2.00). In fact, the booklets on the subject can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C. It may be, the production of war materials has reached its peak. This means industry will have to look toward manufacturing civilian goods, and at the same time an unemployment epidemic will start. From unemployment there will be set in motion the beginning of many, many strikes.

## OUTLOOK FOR GERMANY AFTER DEFEAT

It may be, all conditions to be imposed on Germany as a defeated nation have been completed and largely agreed upon. The conditions will be administered by an occupation commission representing Russia-Britain-U. S. (that's US at the tail end. These deals most always turn out that way, don't they?) By the way, the conditions seem to take care of everything with the exception of those responsible for the war. How to handle these war criminals has not been decided. Now, doesn't it seem reasonable if the representatives formulating the defeated conditions for Germany, can't decide the problem of what to do with the Hitlers, Goebbels and the Goerings, then their complete set-up of conditions can't have too much substance at this time?

## LET'S TAKE A LOOK

Let's take a look at some of the angles which basically place U. S. as a "tail end Charlie" in this deal. Britain has already given us a run around by signing trade pacts for bulk purchases along with other important foreign trade deals. Russia has a state monopoly which it intends to continue after the war. France is now setting up machinery for government control of all her imports and exports. Belgium plans to trade with Britain, Russia and France, although she has U. S. currency. Holland plans to follow the footsteps of Belgium. So there you have a fine situation, one which shows Uncle Sam sitting somewhere way in the back, apparently satisfied with having his aliens outsmarted by our Lend-Lease friends.

## SURPLUS WAR MATERIALS

It may be possible, many fortunes will be made in dealing in Surplus War Materials. It is estimated there will be a disposal of well over 100 billion dollars worth of these materials. Some say this figure is high—others say not. The government-owned real estate to be disposed of in itself will be a large figure. Some concerns are going to pick up some beautiful buildings suitable to manufacturing at a bargain price. You can bet your life Congress will try some fancy shenanigans to prevent large profits being made from war surplus materials, but they really won't be able to do much about it.

## UNEMPLOYMENT PAY

There will be much talk by politicians regarding higher pay for the unemployed, but in the end, nothing will come of it. The whole matter will fall back on the individual states and the compensation rate will remain the same as in the past.

## LABOR BOARD

Could it be that Chairman Davis and Mr. Meany of A. F. of L. are not congenial bedfellows? Rumor has it they are at terrific odds. At the moment each is putting on the gloves for a free-for-all.

## FARM LAND

After the war there may be heavy buying of farm land in the mid-west by discharged soldiers. Land prices have already increased 15 per cent and still going upward. Farmers are paying off their mortgages at an all-time high, while on the other hand FCA is lending at an all-time low.

## SCHOOL LUNCHES

Congress has appropriated 50 Million Dollars to continue the school lunch program for another year. While schools are not open now, this assures the continuance of this program during the next school year.

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## Ordnance Taking More Nitrogen

Production of nitrogenous fertilizer materials for use on American farms will be adversely affected by the curtailment of industrial supplies of nitric acid now critically needed by ordnance plants, the War Production Board reported on August 11th.

As a result of recently increased ordnance requirements, shipments to industry of nitric acid produced in ordnance plants will cease after October 1, 1944, WPB officials recently informed the Nitric Acid Producers Industry Advisory Committee.

Prior to the action, the prospective supplies of nitrogenous fertilizers for use in 1944–45 were below estimated requirements. Although this action darkens the outlook, WPB officials said, it will still be possible to offset the action, at least in part, if arrangements can be made for larger imports of Chilean nitrates for agricultural use.

Nitric acid is used in the production of commercial explosives, plastics, dyestuffs, textiles, refrigerators, rubber, films, photographic equipment and many industrial chemicals, as well as in agriculture and for the metal treating and petroleum refining industries.

Also to be discontinued (effective September 1, 1944) because of increased war requirements are supplies of anhydrous ammonia from ordnance plants. This ammonia is used in the production of commercial explosives, plastics, refrigerators, fertilizers and industrial chemicals. Similarly, ammonium nitrate, essential to the fertilizer program, is not being shipped to industry from ordnance plants after August 15, 1944. However, this will not interfere with continued delivery of ammonium nitrate fertilizer from Tennessee Valley Authority and Canadian plants.

Rehabilitation of pot muffle plants for the production of nitric acid was discussed by officials of the Chemicals Bureau with the committee.

Pot muffle processing plants, utilizing nitrate of soda and sulphuric acid as raw materials, were shut down a year ago to conserve nitrate of soda for agricultural use. With few exceptions, nitric acid has since been produced by means of a synthetic process using ammonia.

After October 1st, industry will receive first call for the available supplies of nitric acid from industry sources for direct and indirect war uses. The consequent reduction in nitrogen solutions and salts will be reflected in the lesser quantities made available for agricultural use, the committee was informed.

The committee also recommended that sufficient allocations of sodium nitrate be granted to any company having available pot muffle capacity that it may desire to operate for the production of nitric acid. The committee suggested that WPB attempt to make additional shipping space available for the importation of increased quantities of sodium nitrate from Chile.

## Dorothy Germain Wins Western Golf Laurels

Friends of J. H. Germain, of F. W. Tunnell & Co., fertilizer manufacturers, of Philadelphia, are congratulating him on the success of his daughter Dorothy in big-time golf competition. Miss Germain, who is a student at Beaver College, was runner-up in the Western Open Tournament, losing in the finals to the well-known professional, Babe Didriksen. A few weeks later, in the Western Amateur Tournament, she successfully defended her title which she had won the year previous. This is the first time since 1921 that any golfer had won the Women's Western Amateur Championship two years in a row.

## August Crop Report

Total crop production may exceed that of last year by 2 or 3 per cent, according to the U. S. D. A. crop report of August 10th. Total corn production is forecast at 2,929,117,000 bushels, or about 5 per cent below last year, with an average of 30 bushels per harvested acre. With a grain sorghum crop 43 per cent larger than last year, the total crop of feed grains may reach 112,000,000 tons, 3,000,000 less than last year and 11,000,000 less than the record established in 1942. Hay production is estimated at only 97,000,000 tons, which will make the smallest supply per unit of livestock in any of the last six years. Pasture and range conditions are generally poor, except in the western and northeastern states. Total wheat production is now forecast at 1,132,105,000 bushels, the largest crop in history, and winter wheat production 50 per cent above last year, with 18.6 bushels per acre.

Total apple crop may be 41 per cent above, and for eight deciduous fruits, 31 per cent above last year, with citrus fruit conditions above average; sugar beet production 12 per cent and tobacco about 15 per cent above last year, while peanuts are only slightly above, and sugarcane slightly below last year's crop. Total rice production may be 2 per cent less, soybeans 9 per cent less, sweet potatoes 10 per cent less, and Irish potatoes 17 per cent less than the record crop of last year. Total tonnage of truck crops for fresh market may exceed that of last year by 20 per cent, and the 1942 record crop by 12 per cent. Tonnage of eleven commercial truck crops for processing will be 13 per cent above last year.

## Sulphur Output Increases During June

During the first six months of 1944 native sulphur was consumed at a record rate according to the Bureau of Mines, United States Department of the Interior. Shipments from the mines were 28 per cent greater than in 1943.

Production was 7 per cent higher than in 1943, but it was somewhat less than the 1,778,269 tons recorded in the first six months of 1942. Notwithstanding the production increase, stock piles were reduced by 293,827 tons, about 7 per cent of the stocks on hand at the beginning of the year.

| Period | Production | Mine shipments | Producers' stocks |
|---|---|---|---|
| May, 1943..... | 232,637 | 244,142 | 4,988,230 |
| June, 1943..... | 219,589 | 268,215 | 4,917,885 |
| May, 1944..... | 278,751 | 365,543 | 4,200,031 |
| June, 1944..... | 280,545 | 311,199 | 4,168,394 |
| January-June, 1943. | 1,329,222 | 1,369,179 | 4,917,885 |
| January-June, 1944. | 1,426,792 | 1,756,175 | 4,168,394 |

# Obituary

## William S. Stowell

William S. Stowell, president of Chemical Construction Corporation, died in New York on August 6th, at the age of 60 years.

Mr. Stowell, after graduating from Cornell University, engaged in construction work for several years and in 1917 became chief engineer for the American Cyanamid Company. During World War I he helped construct the nitrogen plant at Muscle Shoals. In 1931 he was made president of Chemical Construction Corporation and since that time had been in charge of chemical plant construction in many parts of the world. During the present war, his company has had an important part in the development of the chemical program in this country and Canada. Mr. Stowell had been a director of the American Cyanamid Co. since 1923.

He is survived by his mother and by a sister, Mrs. Ruth S. Hardy.

# The American Chemical Society

*Abstract of some of the Papers to be presented at the Meeting of the Division of Fertilizer Chemistry at New York City, September 11 to 15, 1944, H. B. Siems presiding.*

### The Minor Elements in Citrus Fertilization in Florida

*A. F. Camp, University of Florida Citrus Experiment Station, Lake Alfred, Fla.*

The history of the Florida citrus industry with regard to soils and fertilizers is discussed to show why it was eventually necessary to add a number of elements to the usual nitrogen, phosphorus, and potash in order to obtain satisfactory production and tree condition. The research by which magnesium, manganese, copper, and zinc were eventually added to the nutrient list as either sprays or fertilizer constituents will be reviewed briefly. Particular attention will be paid to these elements as limiting factors in both experimental plots and commercial production and the eventual substitution of the so-called "subtractive" method of experimental work for the "additive" system. An outline of the production program which has resulted from the research work and which includes in addition to the elements mentioned above a program of pH control of the soil and a complete spray program, including nutrient as well as insecticidal and fungicidal applications, will be given.

The over-all effect of the new program during the last ten years will be discussed, showing its effect in practically doubling production per acre, improving the quality of the fruit itself, and increasing the resistance to cold of both the tree and the fruit. Its effect in improving the plant disease situation and greatly complicating the insect control problems will be included.

### The American Potash Industry Meets Its Wartime Test

*J. W. Turrentine, President, American Potash Institute*

In meeting the potash requirements of the nation's fertilizer and chemical industries, as demonstrated by its current performance, the American potash industry has now attained the goal which it assumed as an entirely voluntary obligation in planning its contribution to the nation's war effort. Since 1939 it has increased its annual deliveries from 312,000 tons $K_2O$ in that year to 711,000 tons $K_2O$ in 1943, a rate of progress which shows no slackening in 1944. In addition to the needs of the United States, Canadian requirements are being supplied on terms of exact equality with our own and exports are being made to our "good neighbors," the republics to the south of us and to even more remote friendly nations. During this period the requirements of the chemical industries have increased from 15,000 tons $K_2O$ in 1938 to some 100,000 tons currently and Lend-Lease exports have been made to the United Kingdom, now replaced by supplies from Spanish sources. During the fiscal year 1944–45 the American Potash industry proposes to provide for all of these purposes a total of some 890,000 tons $K_2O$ to be delivered in the form of over 1.6 million tons of potash salts, of which high-grade muriate, potassium chloride, will exceed one million tons.

Of particular interest to the fertilizer industry is the prospective supply for agricul-

(Continued on page 20)

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# FERTILIZER MATERIALS MARKET

## NEW YORK

**Increased Munitions Program Diverts Chemicals from Fertilizer Production. Superphosphate Production Goal Lowered by Shortage of Manpower and Sulphuric Acid.**

*Exclusive Correspondence to "The American Fertilizer"*

NEW YORK, August 22, 1944.

### Ammoniates

Conditions have changed and with the diversion of ammoniates from fertilizer manufacturers to munitions manufacturers the possible shortage indicated in our last letter will now probably develop.

### Ammonium Nitrate

Shipments of ordnance material for industry was stopped on August 15th.

### Nitrate of Soda

Due to the expected shortage of ammoniates, attempts are now being made to increase imports of Chilean nitrate, but from last reports only about 800,000 tons are expected in this market for the coming year.

### Superphosphate

Increased Army demands for sulphuric acid will affect the superphosphate manufacturers. The Government's original requirements of ten million tons of superphosphate have now been revised and not over eight million tons can be expected, but again this is subject to the manpower shortage which is prevalent throughout the country in fertilizer plants.

### Potash

The production of this material has not been interfered with and there is no indication we will not reach the expected increased production.

### Phosphate Rock

Deliveries are continuing and with the reduced supply of sulphuric acid probably all demands for rock by acidulators will be met.

## BALTIMORE

**Little Change in Market. Demand for Sulphuric Acid in Munitions Hinders Superphosphate Production.**

*Exclusive Correspondence to "The American Fertilizer"*

BALTIMORE, August 22, 1944.

There have not been any new or outstanding features in the fertilizer situation since last report except that the Government will require increased supplies of sulphuric acid for munitions, which will have a tendency to curtail the tonnage of superphosphate that would otherwise be made.

*Ammoniates.*—The situation is unchanged, and the bulk of organics is still being used for feeding purposes because ceiling prices make them almost prohibitive for fertilizer purposes.

*Castor Pomace.*—The demand continues steady and producers are in well sold-up positions for some months to come.

*Fish Scrap.*—The catch remains poor, and such tonnage as is being produced is being delivered against contracts previously booked. Practically the entire production is going into feeding materials.

*Sulphate of Ammonia.*—The situation remains unchanged, and deliveries still being allocated. There is a prospect, however, of a larger proportion of liquid ammonia being used for munition purposes which will have a tendency to create shortage unless there should be a sudden termination of European hostilities.

*Nitrate of Soda.*—Due to the tight situation on mineral ammoniates, considerable thought is being given to bringing in additional supplies of Chilean nitrate for use in mixtures.

*Superphosphate.*—The market is firm at present ceiling of 65 cents per unit of A. P. A. in bulk, f. o. b. producers' works, Baltimore, but no producer is taking on any new business, and no stocks are accumulating. The

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situation is firm and will probably continue so for some time to come.

*Potash.*—Fertilizer manufacturers are continuing to take deliveries against contracts and on account of experience with the labor situation during the past season, many of them will probably begin formulating and shipping earlier than usual next spring.

*Bone Meal.*—Such limited quantities as are obtainable are finding ready sale for feeding purposes, and prices are almost prohibitive for fertilizer use.

*Bags.*—There has been no change in the situation in the market on new burlap bags which are now obtainable for fertilizer purposes without restrictions.

## CHARLESTON

**Shortage of Fertilizer Organics Continues. Shipments of Ordnance Ammonium Nitrate Discontinued. Shortage of Sulphuric Acid.**

*Exclusive Correspondence to "The American Fertilizer"*

CHARLESTON, August 21, 1944.

*Organics.*—These continue extremely scarce with no apparent improvement in sight.

*Ammonium Nitrate.*—Due to munition requirements, all shipments of Ordnance material to the fertilizer manufacturers were stopped on August 15th. This, however, does not apply to shipments from other suppliers.

*Sulphate of Ammonia.*—This material is moving as quickly as produced, and naturally the inquiry has increased on account of ammonium nitrate being taken off the market.

*Bone Meal.*—This material continues scarce and, at prices quoted, is moving only to feed concerns.

*Castor Pomace.*—Demand for this is far ahead of production and will probably continue so for several months.

*Superphosphate.*—In addition to the difficulty that rock miners are experiencing to produce rock to fill the demand, the recent cut in sulphuric acid supplies to the fertilizer industry is making it extremely doubtful that the superphosphate manufacturers will be able to reach the goal on superphosphate set by the Government.

## TENNESSEE PHOSPHATE

**Crops Improve with Better Weather. Phosphate Shipment Hampered by Assorted Difficulties. Some Rock Being Shipped from Florida.**

*Exclusive Correspondence to "The American Fertilizer"*

COLUMBIA, TENN., August 21, 1944.

The usual hot August weather of this section has been greatly tempered by the continued falling of occasional rains making up somewhat for the extreme shortage of moisture during most of 1944 and putting many farmers in far better spirits than pervaded this area a month ago. Most of the early planted corn was already too far gone to be helped a great deal, but there are some really fine corn crops in places and some extra fine tobacco, some of it already curing in the barns. Much is still in the fields, while very many poor crops are scattered over the entire section. Much tobacco ground has already been broken and seed bed is under preparation for grain seeding, alfalfa, etc.

Shipments of all classes of phosphate into all consuming channels have been much curtailed in July and so far in August by an unfortunate cumulative set of difficulties, including shortage of water for washing, shortage of manpower for operation of bagging and grinding and loading, accompanied by numerous breakdowns of overworked and under-manned machinery in washing, drying and grinding departments. Nevertheless, shipments of ground rock for direct application so far in 1944 exceed by 30 per cent those for same period in 1943.

All distributors of Tennessee product have more orders than they can possibly fill and two or three of them are drawing on Florida

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producers for both colloid phosphate (the product reclaimed from waste ponds of old hard rock mines) and for all the regular grades of merchantable rock which can be ground in the established grinding facilities not engaged in production for acidulators the entire time.

Governmental agencies are sure to see the folly of trying to get into the job of production and distribution of fertilizer at wholesale costs with the expense of selling and distribution put on the taxpayers, and will confine their work to the eminently proper one of promoting soil conservation and all fertilizer sales, benefit payments under conservation plans or programs and leave to the regular producing and selling organizations the job of supplying the fertilizers and materials. The mistake which put the Government improperly into the actual sale and distribution, was the unjustifiable belief that fertilizer prices were too high. This has long since been exploded, even in the most radical minds, and any danger of that feature in future is adequately covered by the OPA regulations putting ceilings on all.

## CHICAGO

**Labor Shortage Contributes to Lack of Fertilizer Organics. Feed Material Market Unchanged.**

*Exclusive Correspondence to "The American Fertilizer"*

CHICAGO, August 21, 1944.

Definite lack of offerings continues highlighting the organic market. Demand is consistently steady, and sellers are apparently unable to satisfy it. Lack of labor is frequently mentioned as one cause of the falling off of offerings.

Steamed bone meal is another scarce fertilizer material and prospects for an improvement in supplies in the near future are not encouraging.

In feeds there appears but little change. constituent of mixed fertilizers, during 1943–Some mixers maintain the demand has slowed, while others report no let down in orders.

Ceiling prices are:

High grade ground fertilizer tankage, $3.85 to $4.00 ($4.68 to $4.86 per unit N) and 10 cents; standard grades crushed feeding tankage, $5.53 per unit ammonia ($6.72 per unit N); blood, $5.53 ($6.72 per unit N); dry rendered tankage, $1.25 per unit of protein, f. o. b. producing points.

## New Superphosphate Ceiling for Lake Charles, La.

In Amendment 2 to RMPR-205, a new ceiling on superphosphate produced at Lake Charles, La., has been set by OPA. At the time the original ceilings were established, the new plant at Lake Charles was not in production, and on the basis of estimated costs of production a ceiling of 66 cents per unit of A. P. A. was established. In view of higher delivered costs of materials, the ceiling for this plant has been raised to 70 cents, which is the same as that previously established for Shreveport.

### THE AMERICAN CHEMICAL SOCIETY

(Continued from page 16)

ture in the United States, Puerto Rico, and Hawaii of 750,000 tons $K_2O$, for the so-called fertilizer year 1944–45, of which 640,000 tons were subject to allocation by the War Production Board during its Period 4, and the balance during Period 5. Since the fertilizer industry is at present the sole retailing agency for agricultural potash, this tonnage is subject to its option and constitutes the supply for our war food program. This is to be distributed to the farmers of the nation principally as a

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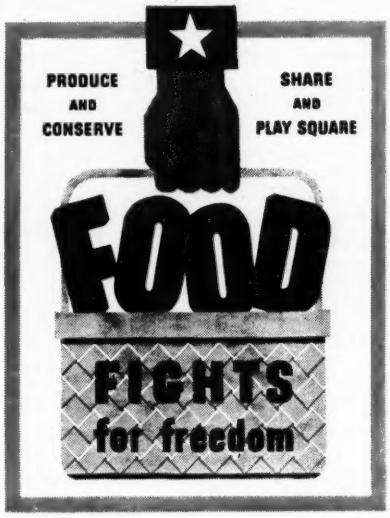


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44 amounting to 7,750,000 tons. Lesser amounts are retailed as potash salts, in former years estimated at 10 per cent of the total, but last year amounting to only a fraction of that percentage. The adequacy of this supply is indicated by the fact that it provides 75,000 tons $K_2O$ for retailing as potash salts and 685,000 tons $K_2O$ for mixed goods, sufficient for an 8.5 per cent $K_2O$ average content of 8,000,000 tons, the probable limit on mixed goods output under current labor conditions. The attainment of any one of these accomplishments means a record-breaking achievement, in line, however, with what the nation expects of us.

While this unprecedented potash supply still falls short of the amounts that the agricultural authorities tell us should be used in American agriculture for the most efficient and profitable crop production, particularly at this time of war food demands, it still exceeds the amounts previously purchased by the American farmer; however, the long-standing and consistent parallelism between the farmer's income and what he spends for plant food leaves little doubt that he is prepared to buy this increased supply of potash with his currently unequaled income of $20,000,000,000, especially so now that other competing commodities are in limited supply.

For years past the fertilizer industry has made progress in teaching the farmer to put more emphasis on the plant food content and less on the price per ton of the fertilizer mixtures purchased, efforts now to bear fruit during this period of farm prosperity and limited output of mixed goods tonnage due to the restricted labor supply in fertilizer plants with little prospect of substantial improvement. Surely the farmer under pressure from all sides to make the most of his facilities, also limited, to obtain his maximum output needs little persuasion to apply his abundant funds to the purchase of quality instead of bulk. With the large supplies in prospect of all three major plant foods, nitrogen, phosphate, and potash, and with limitations imposed on the number of tons into which they can be mixed, the farmer's only chance of procuring his share of this abundance is through the use of the high-analysis mixtures.

### Mechanism of Caking

*C. K. Lawrence, The Solvay Process Company, Nitrogen Division*

Caking of solid particles occurs when there is crystallization from liquid phase at points of particle contact. The liquid phase usually is generated by hygroscopic absorption. The crystallization is subsequently induced by water evaporation, temperature lowering, chemical reaction, hydration or transformation of crystal form, and is influenced by pressure. Alleviating measures include limiting access of moisture, use of conditioners, choice of favorable form of product, curing to expend chemical reactivity, and minimizing pressure.

### The Preparation of Ammonium Nitrate for Use as a Fertilizer

*William H. Ross, J. Richard Adams, J. Y. Yee, and Colin W. Whittaker, Division of Soil and Fertilizer Investigations, U. S. Department of Agriculture, Washington, D. C.*

Solid ammonium nitrate is prepared commercially for use as a fertilizer by concentrating the solution to 95 to 98 per cent by (1) Hi-Pan, (2) vacuum, or (3) film evaporation, and granulating the resulting melt by the methods of graining or spraying.

A decrease in the moisture content of ammonium nitrate or a lowering of the temperature results in a greater deposition of crystals and a greater degree of caking than that which takes place for a like change in any other fertilizer material. A gradual increase in moisture content without an accompanying drop in temperature may have an opposite effect. The presence of moisture, however, greatly interferes with the drillability of the material and a subsequent drop in temperature or humidity causes the material to cake to a greater degree than before.

The tendency of granular ammonium nitrate to cake can be greatly reduced by coating the dry material with 0.5 to 1.0 per cent of a suitable water-repellent material, followed by 3 to 5 per cent of a conditioning agent such as kieselguhr, clay, or tricalcium phosphate, and storing in moisture-proof bags. Ammonium nitrate that has been treated in this way will remain in a drillable

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*See Page 4*

condition for prolonged periods in piles at least twelve bags high, providing it is dry when stored and the bags are sufficiently moisture-proof to keep it dry throughout the storage period.

Drillability tests under carefully controlled conditions with standard farm equipment indicate (1) that the drillability of any given material increases with the size of its particles; (2) that the sprayed ammonium nitrate now on the market is more drillable than the grained material due to differences in particle size; and (3) that properly conditioned granular ammonium nitrate is as drillable under humid conditions as commercial sodium nitrate.

### Influence of Nitrogenous Materials on the Moisture Relations of Mixed Fertilizers

*John O. Hardesty and J. Y. Yee, Bureau of Plant Industry, Soils and Agricultural Engineering, Beltsville, Md.*

The moisture content of most fertilizer mixtures is sufficient to dissolve all of the ammonium nitrate commonly present. The resulting increase in volume of the solution phase is accompanied by (1) an increase in the apparent moisture content of the mixture; (2) a rapid reaction between reciprocal salt pairs; and (3) crystallization of other less soluble salts in the mixture. These three changes influence the mechanical condition of the mixture with respect to initial dampness, hygroscopicity, and caking.

The high solubility of ammonium nitrate in conjunction with its reaction in solution with other common fertilizer salts, such as potassium chloride and potassium sulphate, greatly diminishes the unfavorable influence which it would otherwise have on the hygroscopicity of most mixtures.

Moisture absorption tests on 450 samples of popular grades of fertilizer manufactured in different sections of the country during the past two years show that the increased quantities of ammonium nitrate used in mixed fertilizers during the past season have not caused any appreciable increase, as a whole, in the hygroscopicity of the mixtures.

### SOIL FERTILITY IN ITS BROADER COMPLICATIONS

(Continued from page 9)

fertility is thus a cause of no small import in the world wars.

#### Calcium and Phosphorus Are Prominent in the Soil Fertility Pattern as it Determines the Pattern of Nutrition of Plants and Animals

Life behaviors are more closely linked with soils as the basis of nutrition than is commonly recognized. The depletion of soil calcium through leaching and cropping, and the almost universal deficiency of soil phosphorus, connect readily with animals when bones are about the complete body depositories for these two elements. In the forest, the annual drop of leaves and their decay to pass their nutrient elements through the cycle of growth, and decay again, are almost a requisite for tree maintenance. Is it any wonder then that dropped antlers and other skeletal forms are eaten by animals to prohibit their accumulation while their calcium and phosphorus stay in the animal cycle? Deer in their browse will select trees given fertilizers in preference to those untreated. Pine tree seedlings along the highway as transplantings from fertilized nursery soils are taken by deer when the same tree species in the adjoining forests go untouched. Wild animals truly "know their medicines" when they take plants on particular levels of soil fertility.

The distribution of wild animals, the present pattern of distribution of domestic animals, and the concentrations of animal diseases, can be visualized as superimpositions on the soil fertility pattern as it furnishes nutrition. We have been prone to believe these patterns of animal behaviors wholly according to climate. We have forgotten that the eastern forest areas gave the Pilgrims limited game among which a few turkeys were sufficient to establish a national tradition of Thanksgiving. It was on the fertile prairies of the Midwest, however, that bison were so numerous that only their pelts were commonly taken.

Distribution of domestic animals today reveals a similar pattern, but more by freedom

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# Let these guys start it!

**There's a day coming** when the enemy will be licked, beaten, whipped to a fare-thee-well—every last vestige of fight knocked out of him.

And there's a day coming when every mother's son of us will want to stand up and yell, to cheer ourselves hoarse over the greatest victory in history.

**But let's not start the cheering yet.**

In fact, let's not start it at all—over here. Let's leave it to the fellows who are *doing* the job—the only fellows who will *know* when it's done—to begin the celebrating.

**Our leaders** have told us, over and over again, that the smashing of the Axis will be a slow job, a dangerous job, a bloody job.

And they've told us what our own common sense confirms: that, if we at home start throwing our hats in the air and easing up before the job's completely done, it will be slower, more dangerous, bloodier.

Right now, it's still up to us to buy War Bonds—and to *keep on* buying War Bonds until this war is completely won. That doesn't mean victory over the Nazis *alone*. It means bringing the Japs to their knees, too.

**Let's keep bearing down** till we get the news of final victory from the only place such news can come: the battle-line.

If we do that, we'll have the *right* to join the cheering when the time comes.

## Keep backing 'em up with War Bonds

from "disease"—more properly freedom from malnutrition—and by greater regularity and fecundity in reproduction. It is on the lime-rich, unleached, semi-humid soils that animals reproduce well. It is there that the concentrations of diseases are lower and some diseases are rare. There beef cattle are multiplied and grown to be shipped to the humid soils where they are fattened. Similar cattle shipments from one fertility level to another are common in the Argentine.

In going from midwestern United States eastward to the less fertile soil, we find that animal troubles increase and become a serious handicap to meat and milk production. The condition is no less serious as one goes south or southeastward. The distribution patterns of milk fever, of acetonemia, and of other reproductive troubles, that so greatly damage the domestic animal industry, suggest themselves as closely connected with the soil fertility pattern that locates the proteinaceous, mineral-rich forages of higher feeding values in the prairie areas but leaves the more carbonaceous and more often deficient feeds for the East and Southeast with their forest areas. Troubles in the milk sheds of eastern and southern cities are more of a challenge for the agronomists and soil scientists than for the veterinarians.

### Experimental Studies Reflect Calcium and Phosphorus as Beneficial Soil Treatments in Physiology of Plants and Animals

Experiments using soil treatments have demonstrated the important roles that calcium and phosphorus can play in the animal physiology and reproduction by way of the forages and grains from treated soils. Applied on adjoining plots of the same area, their effects were registered in sheep as differences in animal growth per unit of feed consumed, and as differences in the quality of the wool. Rabbits also grew more rapidly and more efficiently on hay grown where limestone and superphosphate had been used together than where phosphate alone had been supplied.

The influence of added fertilizers registers itself pronouncedly in the entire physiology of the animal. This fact was indicated not only by differences in the weight and quality of the wool, but in the bones and more pronouncedly in semen production and reproduction in general. Rabbit bones varied widely in breaking strength, density, thickness, hardness and other qualities beside mass and volume. Male rabbits used for artificial insemination became sterile after a few weeks on lespedeza hay grown without soil treatment, while those eating hay from limed soil remained fertile. That the physiology of the animal, seemingly so far removed from the slight change in chemical condition in the soil, registered the soil treatment, is shown by the resulting interchange of the sterility and fertility of the lots with the interchange of the hays during the second feeding period. This factor of animal fertility alone is an economic liability on less fertile soil, but is a great economic asset on the soils that are more fertile either naturally or made so by soil treatments.

### Animal Instincts Are Helpful in Meeting Their Nutritional Needs

Instincts for wise choice of food are still retained by the animals in spite of our attempts to convert the dairy cow into a chemical engineering establishment wherein her ration is as simple as urea and phosphoric acid mixed with carbohydrates and proteins, however crude. Milk, which is the universal food with high efficiency because of its role in reproduction, cannot as yet be reduced to the simplicity of chemical engineering when calves become affected with rickets in spite of ample sunshine and plenty of milk, on certain soil types of distinctly low fertility. Rickets, as a malnutrition "disease" according to soil type, need not be a new concept, so far as this trouble affects calves.

Even if we try to push the cow into the lower levels in the biotic pyramid, or even down to that of plants and microbes that alone can live on chemical ions not requisite as compounds, she still clings to her instincts of selecting particular grasses in mixed pasture herbages. Fortunately, in her physiology she strikes up a partnership with the microbes in her paunch where they synthesize some seven essential vitamins for her. We are about to

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forget, however, that these paunch-dwellers cannot be refused in their demands for soil fertility by which they can meet this expectation. England's allegiance in wartime to cows as ruminants that can carry on these symbiotic vitamin synthesis, and her reduction of the population of pigs and poultry that cannot do so, bring the matter of soils more directly into efficient service for national nutrition than we have been prone to believe.

The instincts of animals are compelling us to recognize soil differences. Not only do the dumb beasts select herbages according as they are more carbonaceous or proteinaceous, but they select from the same kind of grain the offerings according to the different fertilizers with which the soil was treated. Animal troubles engendered by the use of feeds in mixtures only stand out in decided contrast. Hogs select different corn grains from separate feeder compartments with disregard of different hybrids but with particular and consistent choice of soil treatments. Rats have indicated their discrimination by cutting into the bags of corn that were chosen by the hogs and left uncut those bags not taken by the hogs. Surely the animal appetite, that calls the soil fertility so correctly, can be of service in guiding animal production more wisely by means of soil treatments.

Dr. Curt Richter of the Johns Hopkins Hospital has pointed to a physiological basis for such fine distinctions by rats, as an example. Deprived of insulin delivery within their system, they ceased to take sugar. But dosed with insulin they increased consumption of sugar in proportion to the insulin given. Fat was refused in the diet similarly in accordance with the incapacity of body to digest it. Animal instincts are inviting our attention back to the soil just as differences in animal physiology are giving a national pattern of differences in crop production, animal production, and nutritional troubles too easily labeled as "diseases" and thus accepted as inevitable when they ought to have remedy by attention to the soil. The soils determine how well we fill the bread basket and the meat basket.

**Patterns of Population Distribution Are Related to the Soil**

The soil takes on national significance when it prompts the Mayor of the eastern metropolis to visit the "Gateway to the West" to meet the farmers dealing with their production problems. More experience in rationing should make the simple and homely subject of soils and their productive capacity household words amongst urban as well as rural peoples. Patterns of the distribution of human beings and their diseases, that can be evaluated nationally on a statistical basis as readily as crops of wheat or livestock, are not yet seen in terms of the soil fertility that determines one about as much as the other. Man's nomadic nature has made him too cosmopolitan for his physique, health, facial features, and mental attitudes to label him as of the particular soil that nourished him. His collection of foods from far-flung sources also handicaps our ready correlation of his level of nutrition with the fertility of the soil. We have finally come to believe that food processing and refinement are denying us some essentials. We have not yet, however, come to appreciate the role that soil fertility plays in determining the nutritive quality of foods, and thereby our bodies, and our minds. Quantity rather than hidden quality is still the measure.

Now that we are thinking about putting blanket plans as an order over states, countries, and possibly the world as a whole, there is need to consider whether such can blot out the economics, customs and institutions that have established themselves in relation to the particular soil's fertility. Since any civilization rests or is premised on its resources rather than on its institutions, changes in the institution cannot be made in disregard of so basic a resource as the soil.

**National Optimism and Hope Arise Through Wise Attention to Soil Fertility**

Researches in soil science, plant physiology, ecology, human nutrition, and other sciences have given but a few years of their efforts to human welfare. These contributions have looked to hastened consumption of material surpluses from unhindered production for limited territorial use. Researches are now

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to be applied to production, and a production that calls for use of nature's synthesizing forces for food production more than to simple non-food conversions. When our expanded chemical industry is permitted to turn from wartime to peacetime pursuits, it is to be hoped that a national consciousness of declining soil fertility can enlist our sciences and industry into rebuilding and conserving our soils as the surest guarantee of the future health and strength of the nation.

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## POST-WAR PROBLEMS IN AGRICULTURE

(Continued from page 12)

is reasonable to expect that mechanically picked cotton can be delivered to the mills with a grade that will be satisfactory to them.

The increased efficiency, not only in the production of cotton but of other crops as well, brings on the problem of over-production. It is possible for farmers with favorable conditions any year to produce a surplus of cotton. As stated in the beginning of this paper, our post-war problems in agriculture will be very materially affected by whatever agreements are reached at the peace conference after the war. It might be desirable to have an international cotton agreement similar to that proposed by the wheat growers. In any event, it seems highly desirable that our cotton industry should have the support of a strong organization which would represent all phases of the industry. An organization of this kind, wisely conducted, with proper support and representation from all branches of the industry, could accomplish a great deal more than each group working independently.

Georgia, and a large part of the South, is very dependent upon the use of commercial fertilizers for profitable yields. At the present time the farmers of this State are using approximately one million tons of fertilizers annually.

This represents a large per cent of their cost of production. On the other hand, research indicates that commercial fertilizers account for slightly more than half of our cotton yields, a little more than two-thirds of our tobacco yields, about one-fourth of our wheat and from one-half to 90 per cent of our yield of vegetable crops. We are also learning that proper fertilization of grassland is just as important as fertilizing cultivated crops. It is obvious then that more intelligent use of fertilizers will be an extremely important factor in our post-war agriculture.

Then last but by no means least in importance in the South is the problem of our system of farm tenure. The enormous annual turnover of both share-croppers and tenants has been for a long while, and still is, one of the most serious problems with which southern agriculture has had to deal. It has been a big stumbling block in the way of the livestock and soil conservation phases of our farm program. It has also had a very detrimental influence upon the economic and social development of our farm people. However, we have many examples and records of successful landlord-tenant relations that have worked to the distinct advantage of both parties. In many cases the third generation of tenants is living on the same farm. These cases, as a rule, involve the most successful landowners and the best tenants. Since the number of tenants and sharecroppers on southern farms will likely remain large for a long time to come, it seems highly desirable to encourage wider application of a system of tenure mutually beneficial to landlords and tenants alike. A study of some of the successful examples now in operation would doubtless contribute a basis upon which this system might be developed.

In conclusion, let me say again that, in my opinion, the soundest procedure we can follow in preparing to meet post-war changes and problems is: (1) Recognize the trends and practices that have proven to be the soundest and most successful up to the present. (2) Hedge in every way possible against losing the ground which we have gained along these lines. (3) Use the best that we have as a basis for projecting our plans into the future and in making whatever changes and adjustments the post-war years may require. In order to develop this procedure and render the greatest assistance possible toward the solution of post-war problems, it is essential that all interested groups and agencies lend their best efforts to this end.

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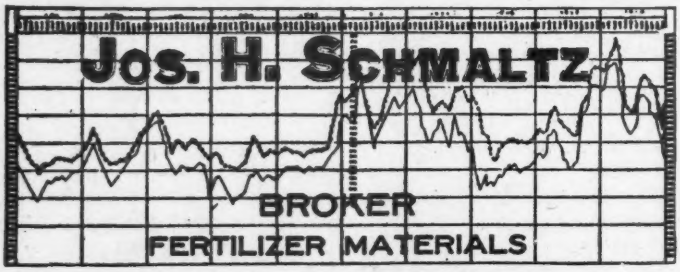


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